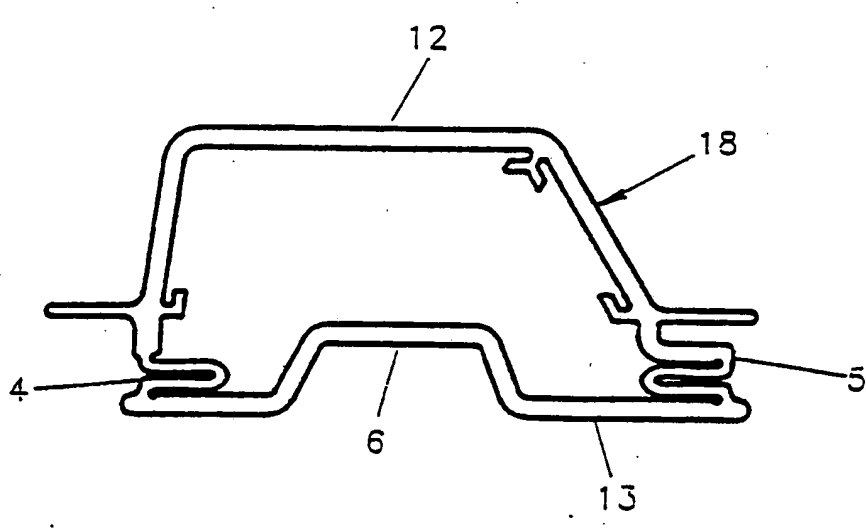




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b>  <b>B60R 19/02, B62D 21/00, 25/02</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 93/04897</b>  <b>(43) International Publication Date:</b> 18 March 1993 (18.03.93)
<b>(21) International Application Number:</b> PCT/NO92/00142 <b>(22) International Filing Date:</b> 4 September 1992 (04.09.92)  <b>(30) Priority data:</b> 913528 6 September 1991 (06.09.91) NO  <b>(71) Applicant (for all designated States except US):</b> NORSK HYDRO A.S [NO/NO]; N-0240 Oslo (NO).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> CLAUSEN, Edvin, List [DK/DK]; Kogsvn. 10, DK-6270 Tønder (DK).  <b>(74) Agent:</b> RICANEK, Ivan; Norsk Hydro a.s, N-0240 Oslo (NO).		<b>(81) Designated States:</b> CS, JP, KR, RU, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> STRUCTURAL BEAM AND THE METHOD OF MANUFACTURING SUCH A BEAM  <div style="text-align: center;">  </div>		
<b>(57) Abstract</b>  A structural beam exhibits cross-sections of variable area along its longitudinal axis achieved by cold deformation (folding) of the side walls of an extruded shape.		

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STRUCTURAL BEAM AND THE METHOD OF MANUFACTURING  
SUCH A BEAM

The present invention relates to structural members in a vehicle frame and more particularly to elongated structural beams and the method of manufacturing such members.

A so-called space frame includes a plurality of elongated structural members joined directly together or by means of cast connecting pieces to provide a skeleton forming the total combined body support and lower frame (chassis) of motor vehicles.

In order to satisfy various requirements with regard to the strength and shape (outer configuration) of the structural members, e.g. door pillars or vertical posts of the frame, the pillars are conventionally provided as spot welded deep drawn steel plates composed of two or more components to form the desired configuration with auxiliary or additional features and functions. In the case of door pillars (posts) the shape customarily has a broader lower section and a narrow upper section at the window area.

It is therefore an object of the present invention to provide a novel unitary structural beam exhibiting desired variations in the cross-sectional configuration along its longitudinal axis.

Another object of the invention is to provide a novel low cost method of manufacturing structural beams eliminating the use of time-consuming welding or working operations.

These and other objects and features of the present invention are achieved by provision of a structural beam and manufacturing method of the same, as it appears from the accompanying patent claims and following description of preferred embodiments of the beam referring to the accompanying drawings, Figures 1-5, where

Fig. 1 is a schematical perspective view of a structural beam according to the invention,

Fig. 2 illustrates a cross-sectional view of the beam taken along line I-I in Fig.1,

Fig. 3 shows a reduced cross-sectional area of the beam taken along line II-II in Fig. 1,

Fig. 4 illustrates another embodiment of the beam exhibiting variations in the cross-sectional area along its longitudinal axis, and

Fig. 5 illustrates an alternative cross-sectional configuration of the beam in Fig. 4.

Referring to Fig. 1 illustrating by the way of an example the structural beam 1 as a middle door pillar or so-called B-post in a vehicle space frame comprising a lower portion 11 extending substantially lineary and an upper narrow portion 18 being slightly bent to fit the vehicle door contour (not shown in the Figure). The door pillar is provided as an integrated unitary shape extruded ready for use with all features ensuring not only

the final functional configuration of the pillar but also facilitating the following manufacturing step resulting in provision of the beam having a variable cross-sectional area along its longitudinal axis. The suitable material for extruding the beam is e.g. aluminium or its alloys or other light metal based materials, e.g. composites having a light metal matrix.

Fig. 2 illustrates the extruded structural beam 1 in a cross-sectional view taken along line I-I in Fig. 1 comprising a closed (box-section) shape 11 having a cavity defined by a pair of substantially parallelly extending walls 12,13 connected by means of transversal side walls 14,15. The transversal side walls 14,15 are provided with grooves 2,2',3,3' defining slightly inadvert (concave) and substantially parallelly extending wall portions 4,5 having preferentially reduced wall thickness compared to the rest of the side walls 14,15.

Applying laterally a compression force  $F$  by means of any appropriate conventional pressure or rolling means/apparatus (not shown in the Figure) along a predetermined part of the structural member, the weakened wall portions 4,5 will fold in a controlled manner resulting in provision of a required cross-sectional area (cavity) as illustrated in Fig. 3.

Fig. 3 illustrating the narrow portion 18 of the beam shows that the distance between the parallel walls 12,13 is reduced to a predetermined/requested dimension defined by the height of the folded wall portions 4,5 without affecting the remaining configuration and dimension of the shape, e.g. the longitudinally extending recessed cavity 6 in the bottom wall 12.

Depending on the actually applied deformation means (apparatus) and preformed folding lines/grooves it is possible to alternate the shape (configuration) of the structural member both dimensionally and directionally along its longitudinal axis.

The advantage of the above described manufacturing method is that the structural member could easily in one operation be adapted to the available space and/or to comply with different requests to the function and additional features along its longitudinal extension.

Another example of such structural beam provided according to the present invention is illustrated in Fig. 4 as a bumper 1 for vehicles.

The bumper 1 is shown as a longitudinal unitary extruded member comprising a central part 11 of substantially rectangular and as extruded closed cross-section (see the sectional view A-A) defined by a pair of parallel extending walls 12,13 connected by transversal side walls 14,15 exhibiting reduced wall thickness. End parts extending on each side of the central part of the reduced cross-sectional area (see view B-B) are formed by gradual folding of the transversal side walls 14,15 and simultaneous bending to provide an outer configuration of the bumper adapted to the vehicle's contour. In order to increase the strength of the bumper the folded side walls 14,15 can be further reinforced, e.g. by means of welding or gluing (not shown in the Figure).

Fig. 5 shows in a cross-sectional view an alternative configuration of the extruded member 1, e.g. the central part 11 in Fig. 4. The transversal side walls 14,15 connecting the parallel extending walls 12,13 are in this case slightly convex shaped, thus facilitating outwardly folding of the member to a required reduced cross-sectional area applying pressure or rolling means (not shown in the Figure).

The scope of the present invention is not limited to the above illustrated and described specific embodiments of the invention. Modifications may be made to the invention without departing from the fundamental inventive principle. Thus, e.g. other materials

than the above mentioned aluminium (alloys) can be applied and several modifications of the illustrated box section configurations of the beam could be actual for different specific types of application.

Claims

1. Structural beam, in particular a structural member in a vehicle frame,  
c h a r a c t e r i z e d i n t h a t  
the structural beam (1) is an integrated unitary extruded shape of closed cross-section exhibiting along its longitudinal axis cavity of variable cross-sectional areas and where reduced cavity areas are defined by at least two substantially parallelly extending folded side walls (14,15) or folded side wall portions (4,5) of the shape.
2. Structural beam according to claim 1,  
c h a r a c t e r i z e d i n t h a t  
the extruded closed shape comprises at least two substantially inadvert and parallelly extending walls (14,15) or wall portions (4,5) of reduced wall thickness.
3. Structural beam according to claim 1,  
c h a r a c t e r i z e d i n t h a t  
the extruded closed shape comprises two substanti-ally convex and parallelly extending walls (14,15).
4. Structural beam according to claim 1, 2 or 3,  
c h a r a c t e r i z e d i n t h a t  
the beam is a door pillar/post in a vehicle space frame.
5. Structural beam according to claim 1, 2 or 3,  
c h a r a c t e r i z e d i n t h a t  
the beam is a vehicle bumper.



6. Method of manufacturing a structural closed beam, in particular for a vehicle frame, characterized in that an extruded shape of closed cross-section is laterally exposed over a predetermined part of its longitudinal extension to a deformation pressure resulting in a controlled folding of at least two substantially parallel extending side walls of the beam or portions of the walls providing a reduced cross-sectional cavity area of the beam.

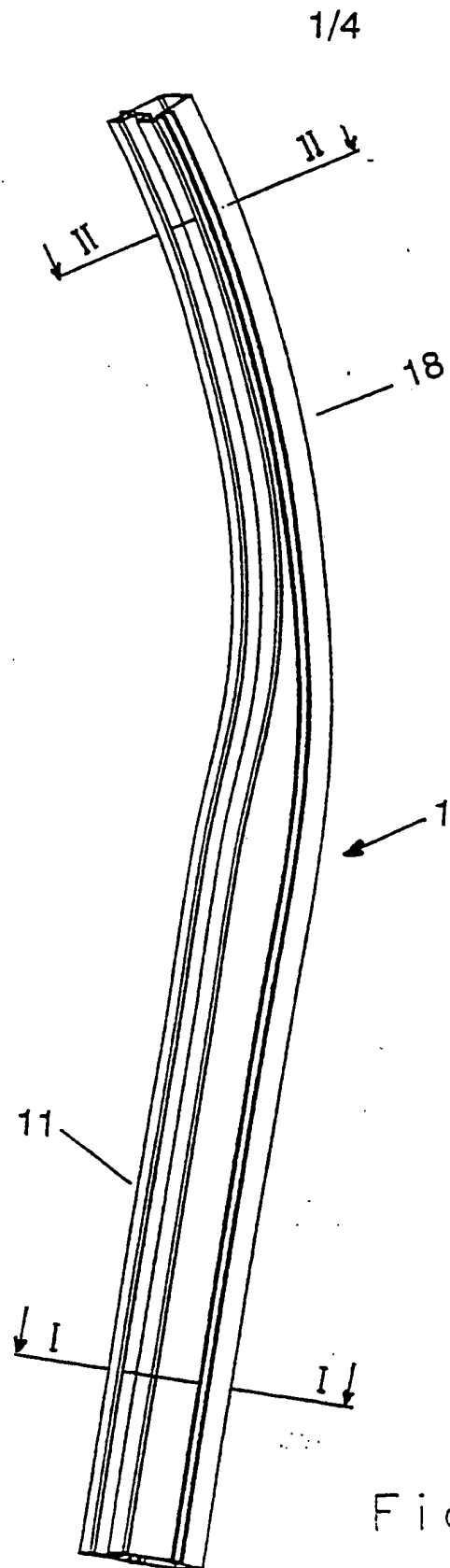


Fig. 1

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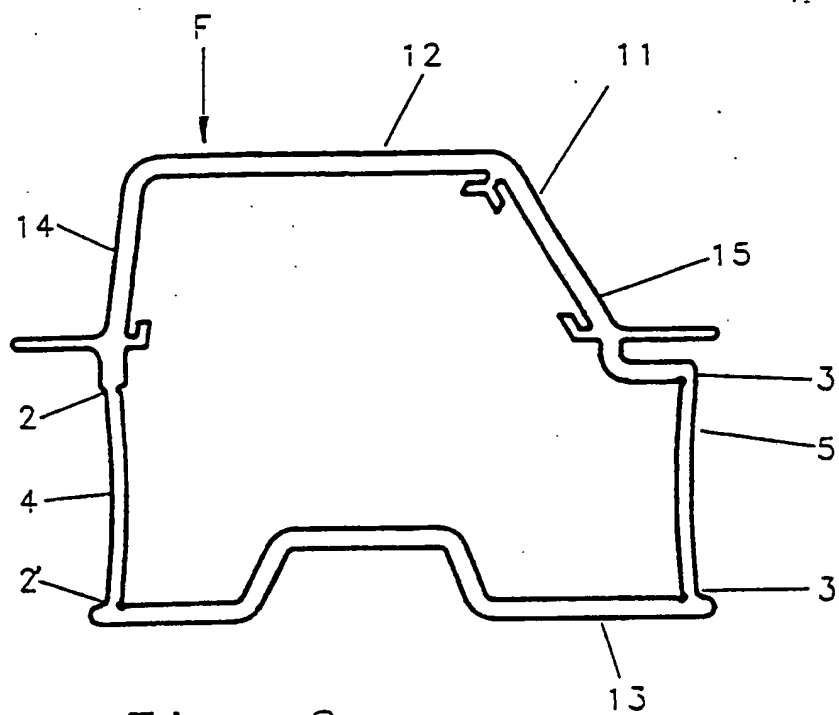


Fig. 2

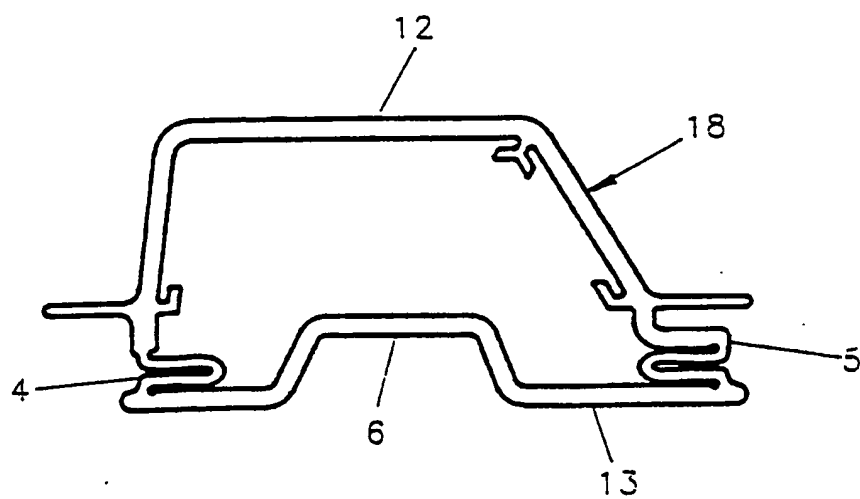
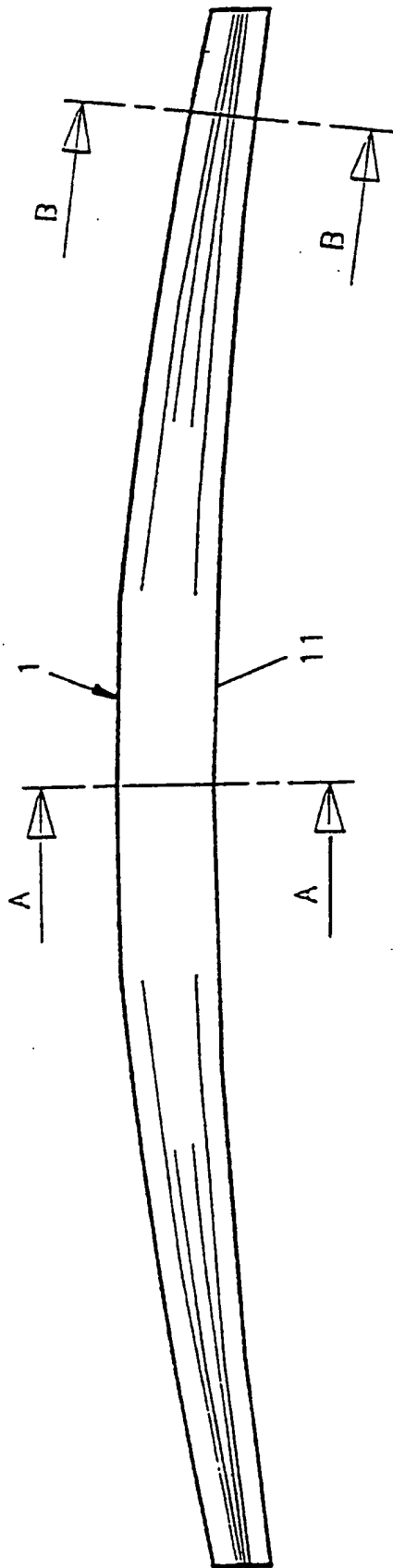
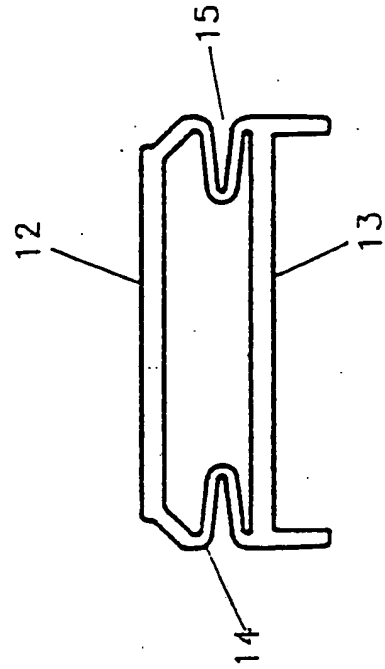


Fig. 3

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B - B



A - A

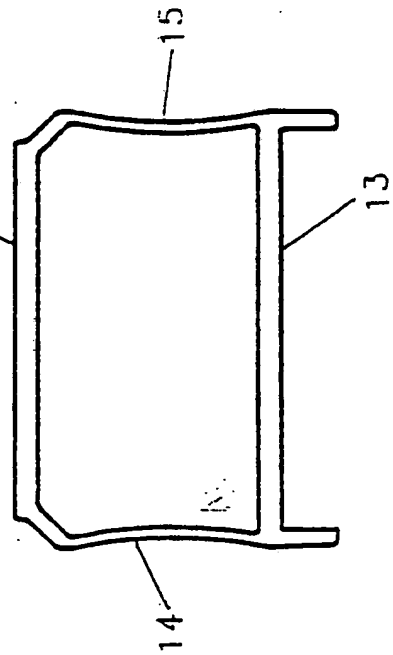


Fig. 4

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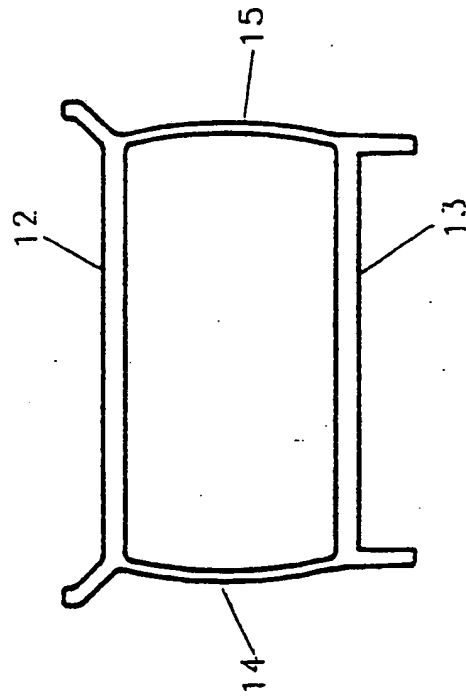





Fig. 5

# INTERNATIONAL SEARCH REPORT

International Application No **PCT/NO 92/00142**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC5: B 60 R 19/02, B 62 D 21/00, B 62 D 25/02</b>																	
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched<sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px; vertical-align: top;">IPC5</td> <td style="padding: 5px; vertical-align: top;">B 60 R; B 62 D; F 16 S</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in Fields Searched<sup>8</sup></div> <p style="padding: 5px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	B 60 R; B 62 D; F 16 S											
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="border-bottom: 1px solid black;">Citation of Document,<sup>11</sup> with indication, where appropriate, of the relevant passages<sup>12</sup></th> <th style="width: 10%; border-bottom: 1px solid black;">Relevant to Claim No.<sup>13</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">DE, C2, 3144844 (AISIN SEIKI K.K.) 3 June 1982, see the whole document --</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">DE, C2, 3510590 (DAIMLER-BENZ AKTIENGESELLSCHAFT) 2 October 1986, see the whole document --</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,5,6</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">EP, A1, 0425059 (MANNESMANN AKTIENGESELLSCHAFT) 2 May 1991, see column 5, line 55 - line 58 --</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,6</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">WO, A1, 9110582 (NORSK HYDRO A.S.) 25 July 1991, see the whole document --</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,2,6</td> </tr> </table>			Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	A	DE, C2, 3144844 (AISIN SEIKI K.K.) 3 June 1982, see the whole document --	1,5	A	DE, C2, 3510590 (DAIMLER-BENZ AKTIENGESELLSCHAFT) 2 October 1986, see the whole document --	1,5,6	A	EP, A1, 0425059 (MANNESMANN AKTIENGESELLSCHAFT) 2 May 1991, see column 5, line 55 - line 58 --	1,6	A	WO, A1, 9110582 (NORSK HYDRO A.S.) 25 July 1991, see the whole document --	1,2,6
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<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px;">7th December 1992</td> <td style="text-align: center; padding: 5px;">10 -12- 1992</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;"><b>SWEDISH PATENT OFFICE</b></td> <td style="text-align: center; padding: 5px;">   <b>Hans Nordström</b> </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	7th December 1992	10 -12- 1992	International Searching Authority	Signature of Authorized Officer	<b>SWEDISH PATENT OFFICE</b>	 <b>Hans Nordström</b>							
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	WO, A1, 9002680 (NORSK HYDRO A.S) 22 March 1990, see the whole document --	1,4
P,A	DE, A1, 4139303 (AUDI AG) 25 June 1992, see the whole document -- -----	1,4,6

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C2- 3144844	82-06-03	NONE	
DE-C2- 3510590	86-10-02	FR-A-B- 2579296	86-09-26
		GB-A-B- 2172856	86-10-01
		JP-A- 61275045	86-12-05
		SE-B-C- 461081	90-01-08
		SE-A- 8601295	86-09-24
		US-A- 4714287	87-12-22
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WO-A1- 9110582	91-07-25	EP-A- 0510060	92-10-28
WO-A1- 9002680	90-03-22	EP-A- 0389588	90-10-03
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